L-19208

CONSOL Energy Inc.

INTEROFFICE COMMUNICATION

TO : F. P. Burke DATE : August 23, 2002

FROM : R. A. Winschel and M. L. Fenger AT (OFFICE) : South Park - R&D

SUBJECT : **MULTI-POLLUTANT EMISSIONS CONTROL PILOT PLANT STUDY-SEMI-ANNUAL TECHNICAL PROGRESS REPORT FOR THE PERIOD ENDING MARCH 8, 2002**

The subject report is attached.

R. A. Winschel
js

cc: R. M. Statnick
M. L. Fenger
J. A. Withum
D. C. McCoy
Technical Records 1621-80

NETL AAD Document Control Bldg. 921
U. S. Department of Energy
National energy Technoogy Laboratory
P.O. Box 10940
Pittsburgh, PA 15236-0940

subject: Cooperative Agreement DE-FC26-01NT41181

Gentlemen:

Enclosed are two paper copies of the Semi-Annual Technical Progress Report for the period ending March 8, 2002, for the subject cooperative agreement. A signed form NETL F 510.1-5 is also enclosed. The enclosed floppy disc contains an electronic version of the report.

Sincerely,
RAW
etc.

DOE COOPERATIVE AGREEMENT DE-FC26-01NT41181
"MULTI-POLLUTANT EMISSIONS CONTROL: PILOT PLANT STUDY OF TECHNOLOGIES FOR REDUCING Hg, SO_3, NO_X AND CO_2 EMISSIONS"

SEMI-ANNUAL TECHNICAL PROGRESS REPORT FOR THE PERIOD ENDING MARCH 8, 2002

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INTRODUCTION

Coal-fired electric generating plants are the largest remaining unregulated source of anthropogenic mercury emissions in the U.S. The U.S. Environmental Protection Agency is under court order to issue a final regulation by December 2004 to reduce these emissions. Power generators would have until December 2007 to comply.

Although no technology currently available eliminates mercury emissions uniformly across the spectrum of power plant configurations, some technologies can reduce mercury emissions from power plants. For example, flue gas desulfurization systems can reduce stack mercury emissions by 50% to 70%. Activated carbon injection may be considered to be the leading technology currently available for maximum removal of mercury; it has been demonstrated at full-scale for short times, but it is very expensive to use.

CONSOL Energy and Allegheny Energy Supply, with support from the U.S. Department of Energy's National Energy Technology Laboratory, are conducting a three-year program to construct and operate a pilot plant using flue gas from a coal-fired power generating station to develop innovative technology for reducing mercury emissions from coal-fired power plants. Other participants are Alstom Power Inc., Environmental Elements Corp., and Carmeuse North America. The technology works by cooling the exhaust gases and permitting the mercury to absorb on the coal fly ash. The fly ash and mercury are then captured in the power plant's existing particulate collection device. An alkaline material is injected to prevent corrosion of the power plant's air preheater and ductwork. In addition to controlling mercury emissions, the technology will reduce the emissions of sulfur trioxide and ameliorate the visible plume problem sometimes associated with selective catalytic reduction applications. The technology can also allow improved generating efficiency, which would lead to lower emissions

of most pollutants and carbon dioxide.

The facility will be built at Allegheny's Mitchell Station in Courtney, PA, and the technology will be tested on a 16,500 lb/h (3640 scfm) slip stream of the flue gases from the 288-megawatt, coal-fired Unit No. 3. The test program includes a series of long-term tests to evaluate the impact of the technology on the performance of specific power station components and mercury stability tests on the collected fly ash.

This is the first Technical Progress Report on this project. The focus of the work to date has been on pre-construction activities. The pilot plant is not yet constructed; therefore, there are no experimental or operating data to report. Instead, this report provides a concise overview and selected details of the pre-construction activities and plans for future work.

TECHNICAL PROGRESS

PRE-CONTRACTURAL ISSUES

Confidentiality agreements were enacted individually between CONSOL and Allegheny Energy Supply, Alstom Power, and Environmental Elements during June and July 2001 to facilitate easy transfer of information among the parties. CONSOL finalized a host site agreement with Allegheny Energy Supply on July 30, 2001.

STATUS OF COOPERATIVE AGREEMENT

The cooperative agreement between DOE and CONSOL Energy was initiated on September 4, 2001. The Hazardous Substance Plan, the report on ES&H approvals, and a request for advance waiver of patent rights were submitted to DOE. The Allegheny Energy Mitchell Station was toured by project participants on October 4, and the project kick-off meeting was held at NETL on October 5, 2001. CONSOL signed amendments M001 and A002 revising reporting requirements and obligating additional DOE funds, respectively.

STATUS OF MAJOR SUBCONTRACTS WITH PROJECT PARTICIPANTS

The subcontract with Alstom Power Inc. was initiated on December 12. Alstom will supply the pilot air pre-heater and associated engineering and reporting services for the project.

The subcontract agreement with Environmental Elements Corp. was executed on February 21. Environmental Elements will supply the pilot electrostatic precipitator (ESP) and various associated engineering and reporting services for the project.

Carmeuse North America, formerly Dravo Lime Co., will also participate in the project by providing magnesium hydroxide slurry produced as a by-product from the flue gas desulfurization unit at Allegheny's Pleasants Station. Contractual

arrangements are not yet in place with Carmeuse.

PROGRESS ON PROCESS DESIGN AND CONSTRUCTION ENGINEERING

Beginning in November, frequent meetings were held with Allegheny Energy personnel at the Mitchell Station to develop plans and gather information for the pilot plant installation. Allegheny's outage coordinator was involved in some of these meetings to make sure that the pilot plant construction is coordinated with the planned outage at Mitchell Station. Close interaction with Alstom Power regarding the design of the air preheater was initiated once the subcontract was put in place in mid-December. A description of the progress on the process design and construction engineering aspects of the project follows.

An engineering and construction schedule was completed. Preliminary equipment list, instrument list, process control and start/stop list, flow sheet, P&I and layout drawings were developed and drafted, and updated as needed.

Calculations on pilot air heater flue gas and air flowrates, temperatures and pressures were completed by Alstom. Flow sheets showing maximum and minimum gas flow rates were developed. Ductwork sizes and pressure drops were calculated and updated as additional information was made available from Alstom. The flowsheets for the pilot plant were finalized. Figure 1 represents maximum flow, and Figure 2 represents minimum flow.

Flue gas velocity, temperature and static pressures at the Mitchell Station air heater inlet duct were measured by CONSOL on January 7. These measurements were made to select the locations for the flue gas duct penetrations.

An engineering services scope of work was formulated for the entire design project. A survey of candidate engineering companies was completed with input from Allegheny. Separate interviews were held in January with three engineering firms in order to bid the preparation of general arrangement drawings of the pilot plant, and S/D Engineers was selected for that job. S/D Engineers completed the general arrangement drawing of the air heater and ESP pilot plant areas in February. The general arrangement drawing is shown in Figure 3.

A request for quotes for the design work, including preparing design drawings and specifications for purchase of materials and construction services, was sent to the same three engineering firms. The bid package included the general arrangement drawings of the air heater and ESP pilot plant areas, mechanical equipment list, instrument list and P&I drawings. Orbital Engineering's bid was selected, and a purchase order was issued in mid-March. Orbital will complete the work in six to eight weeks after initiation.

A layout drawing of the magnesium hydroxide slurry handling area was completed. Plans were formulated for transportation of the concentrated slurry from Pleasants Station and its on-site storage at Mitchell Station.

Alstom and Environmental Elements were asked to review the general arrangement and process controls for the pilot air heater and pilot ESP, respectively.

Mechanical specifications and requests for quotations were sent to vendors for the three fans needed for the pilot plant; i.e., the air ID fan, the gas ID fan, and the gas by-pass fan. The bids were evaluated and a purchase order for the three fans was issued.

A survey of spray nozzle suppliers was completed. Mechanical specifications and requests for quotations were sent to vendors for the water and slurry spray nozzles.

Environmental Elements provided electrical and general arrangement drawings for the pilot ESP. Information on the pilot ESP data collection and operating requirements is still being sought from them.

GAS SAMPLING DETAILS FORMULATED

One of CONSOL's stack samplers visited Mitchell Station on March 8 to make further arrangements for the fairly extensive gas sampling activities that will be required during pilot plant operations. Gas sampling activities are required under Tasks 3 through 7. The CONSOL team reviewed the locations of the gas sampling ports in the pilot plant design, the required type of sampling, and the sampling schedule and frequency at each location, as originally proposed for Tasks 3 through 7. A current schematic of the pilot plant, Figure 4, shows the seven sampling locations in the pilot plant design as circles with an X inside of them. Each of the sampling ports is identified by a letter from A to G.

Both sampling ports E and F are designed to extract samples of the ESP inlet gas, one upstream and one downstream of the humidification spray. It was decided that port E, would be used routinely to extract the ESP inlet gas when the water spray is not in use (Tasks 3 through 5, and parts of Tasks 6 and 7). Both ports E and F will be used during tests when the water spray is in use (parts of Tasks 6 and 7).

It was also decided to add under Task 3, Baseline Performance Testing, one new triplicate set of sampling at all four locations around the air preheater. This new set of samples will help determine flue gas leakage into the air side, air leakage into the flue gas side, and any slip of mercury into the preheated air. This set of sampling will be called Task 3a, Air Preheater Baseline Testing. The remaining part of the original Task 3 will be re-named Task 3b, Pilot Plant Baseline Testing.

No change was recommended to the originally proposed sampling plan for Tasks 4 through 7.

Table 1 shows the specific number of samples to be taken at each location as

now planned for Tasks 3 through 7. Refer to Figure 4 for the location of sampling ports A through G.

Table 2 describes the gas sampling locations and includes a summary of much of the information in Table 1. Table 2 show is the seven gas sampling locations as rows. Three of the columns show the pipe size, and the expected temperature and pressure at each sampling location. The last five columns represent the type of measurement to be made and the Task under which those measurements will be made.

STATUS OF ES&H APPROVALS

The Pennsylvania Department of Environmental Protection determined that this project is exempt from Plan Approval/Operating Permit requirements, and so notified Allegheny via letter on November 29, 2001 (Attachment A). The only remaining ES&H approvals required to proceed with the project are internal to the CONSOL and Allegheny organizations.

PROGRESS ON PUBLIC COMMUNICATIONS

After making revisions per NETL and Allegheny, CONSOL issued a press release on this project on January 10 (Attachment B).

After making revisions per NETL and Allegheny, an abstract for a presentation entitled “The CONSOL/Allegheny Mercury Control Pilot Plant Program” (Attachment C) describing this project was submitted to the Nineteenth Annual International Pittsburgh Coal Conference, which will be held In September. R. A. Winschel is organizing a symposium entitled “Developing Mercury Control Technologies” for that conference.

PLANS AND SCHEDULE

Alstom expects to ship the pilot air preheater to the Mitchell Station on March 18. The Environmental Elements subcontract calls for the pilot ESP to be delivered to Mitchell Station on May 1. Mitchell Station duct penetrations will be installed during the outage, April 22 to May 30. Equipment will be set in place in June. Pilot plant start up will be in July. Figure 5 shows the schedule for the project from December 2001 through July 2002.

Table 1. Gas Sampling Plans by Task, Numbers in Columns Refer to Number of Tests of a Specific Type at a Specific Location, Refer to Figure 4 for Sample Locations

Task 3a - Air Preheater Baseline Test Matrix

Sample Type	Sample Location				
	A	**B**	**C**	**D**	**Process Stream**
Velocity & Temperature Profile	3	3	3	3	
SO_3 Measurements					
Hg Speciation	3	3		3	
Particulate (a)	3	3		3	
Particle Size, Cyclone					
Particle Size, Impactor					
Coal					Daily
ESP Ash					Daily

(a) Particulate, O_2, velocity & temperature measurements obtained with Hg speciation sample

Task 3b - Pilot Plant Baseline Test Matrix

Sample Type	Sample Location			
	A	**E**	**G**	**Process Stream**
Velocity & Temperature Profile	3	3	3	
SO_3 Measurements	3	3	3	
Hg Speciation	3	3	3	
Particulate (a)	3	3	3	
Particle Size, Cyclone		3		
Particle Size, Impactor			3	
Coal				Daily
ESP Ash				Daily

(a) Particulate, O_2, velocity & temperature measurements obtained with Hg speciation sample

Task 4 - Sorbent Optimization Test Matrix

Sample Type	Sample Location

	A	E	G	Process Stream
Velocity & Temperature Profile	6	6	6	
SO_3 Measurements	12	12	6	
Hg Speciation		3	3	
Particulate (a)		3	3	
Particle Size, Cyclone		6		
Particle Size, Impactor			6	
Coal				Daily
ESP Ash				Daily

(a) Particulate, O_2, velocity & temperature measurements obtained with Hg speciation sample

Task 5 - Parametric Test Matrix

Sample Type	Sample Location			
	A	E	G	Process Stream
Velocity & Temperature Profile	9	9	9	
SO_3 Measurements			9	
Hg Speciation	9	9	9	
Particulate (a)	9	9	9	
Particle Size, Cyclone		6		
Particle Size, Impactor			6	
Coal				Daily
ESP Ash				Daily

(a) Particulate, O_2, velocity & temperature measurements obtained with Hg speciation sample

Task 6 - Humidification Test Matrix

Sample Type	Sample Location			
	E	F	G	Process Stream
Velocity & Temperature Profile	9	9	9	
SO_3 Measurements			9	
Hg Speciation	9	9	9	
Particulate (a)	9	9	9	

Particle Size, Cyclone		6		
Particle Size, Impactor			6	
Coal				Daily
ESP Ash				Daily

(a) Particulate, O_2, velocity & temperature measurements obtained with Hg speciation sample

Task 7 - Long-Term Test Matrix

	Sample Location			
Sample Type	**A or E**	**F**	**G**	**Process Stream**
Velocity & Temperature Profile	18	18	18	
SO_3 Measurements			12	
Hg Speciation	18	18	18	
Particulate (a)	18	18	18	
Particle Size, Cyclone		6		
Particle Size, Impactor			6	
Coal				Daily
ESP Ash				Daily

(a) Particulate, O_2, velocity & temperature measurements obtained with Hg speciation sample

Attachment C
Abstract Submitted for the Nineteenth Annual International Pittsburgh Coal Conference

PROGRAM TOPIC AND NUMBER

5. Post-Utilization & Environmental Issues
5.2. Air Toxics, Mercury and PM 2.5

ABSTRACT TITLE

The CONSOL/Allegheny Mercury Control Pilot Plant Program

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ABSTRACT TEXT
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Although no technology currently available eliminates mercury emissions uniformly across the spectrum of power plant configurations, some technologies can reduce mercury emissions from power plants. For example, flue gas desulfurization systems can reduce stack mercury emissions by 50% to 70%. Activated carbon injection may be considered to be the leading technology currently available for maximum removal of mercury; it has been demonstrated at full-scale for short times, but it is very expensive to use.

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